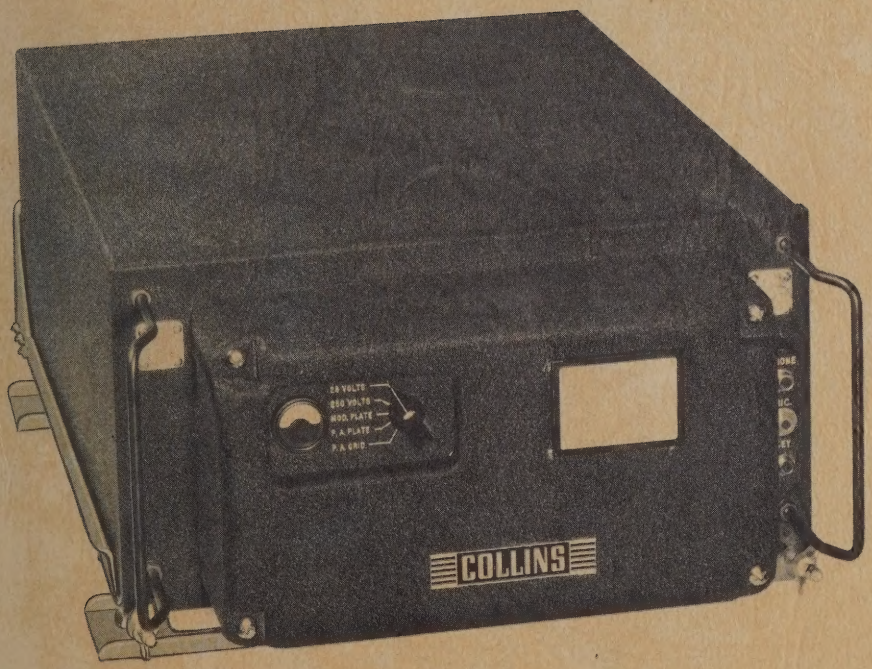
DESCRIPTIVE SPECIFICATIONS

COLLINS 618S AIRLINES TRANSMITTING-RECEIVING EQUIPMENT

Smith-Meeker Engineering Co.
Teterboro Airport
Teterboro, N. J.



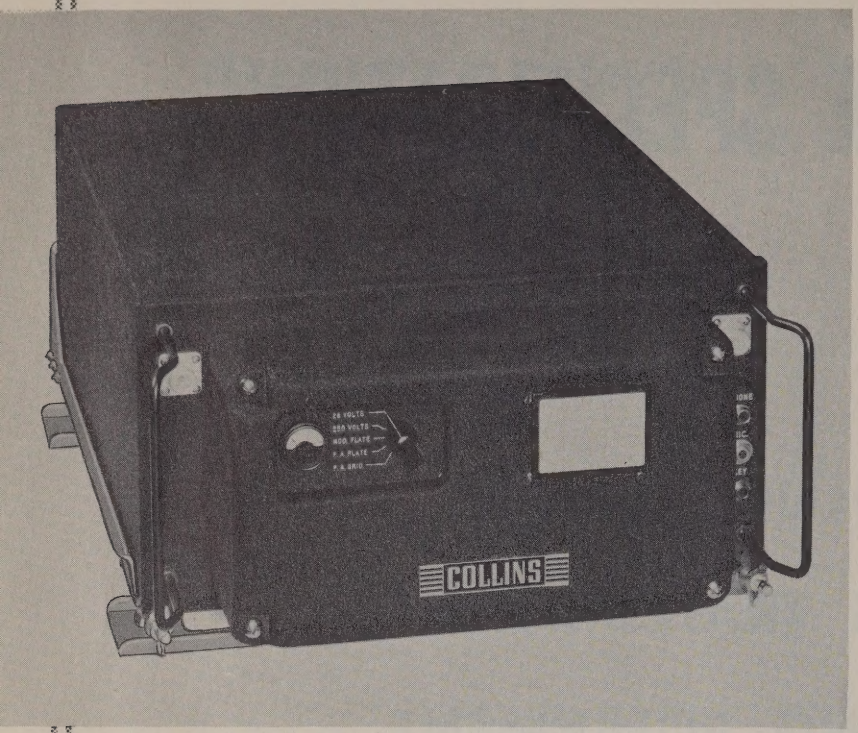
COLLINS

DESCRIPTIVE SPECIFICATIONS

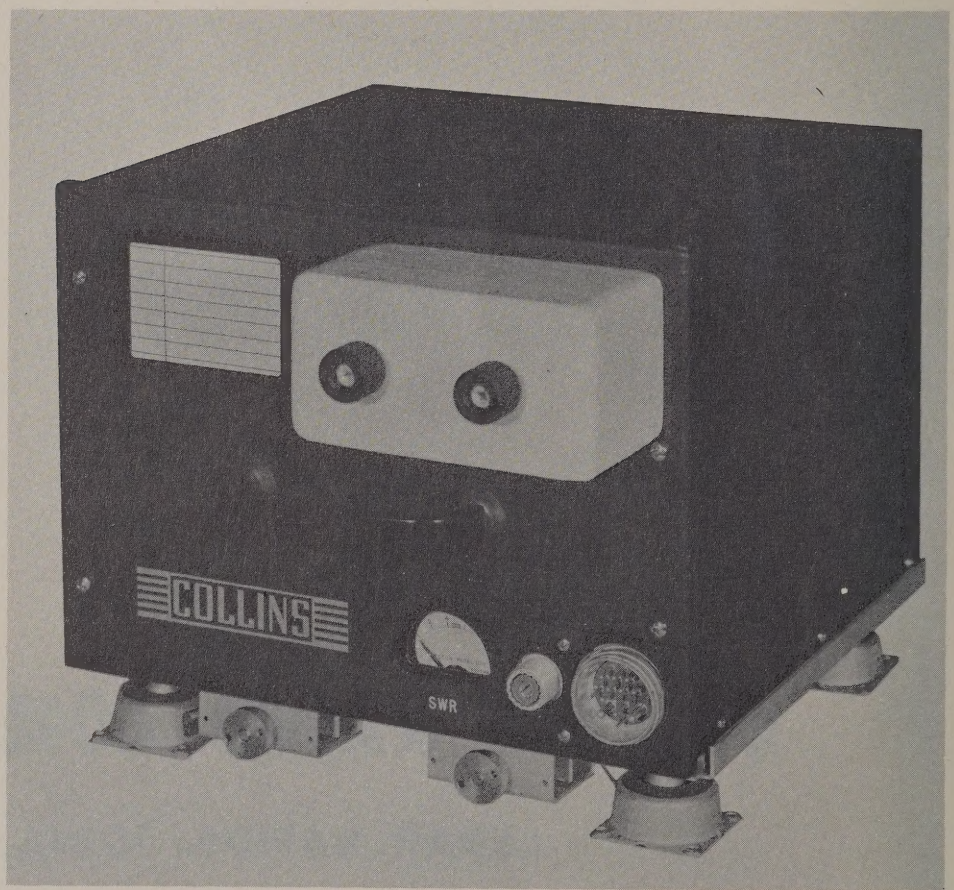
COLLINS 618S
AIRLINES TRANSMITTING-
RECEIVING EQUIPMENT

COLLINS RADIO COMPANY

CEDAR RAPIDS, IOWA



Type 618S-1
Transmitter-Receiver,
Front View



Type 180L-2
Automatic Tuning Unit,
Front View

COLLINS 618S-1 AIRLINES TRANSMITTING-RECEIVING EQUIPMENT

The Collins 618S Airborne Communication equipment is the culmination of more than fifteen years of extensive experience in supplying the needs of commercial Airline Operators. Airline executives will be quick to recognize the advantages of this new, fully integrated radio transmitting and receiving equipment for all commercial aircraft.

The Type 618S Transmitting and Receiving equipment fulfills all current requirements for world wide airlines high frequency radio communications.

The special requirements for which this new equipment was designed, are as follows:

1. Large number of frequency channels required by international flight.
2. System flexibility.
3. Automatic tuning.
4. Modular construction.
5. Provision for possible future requirements.

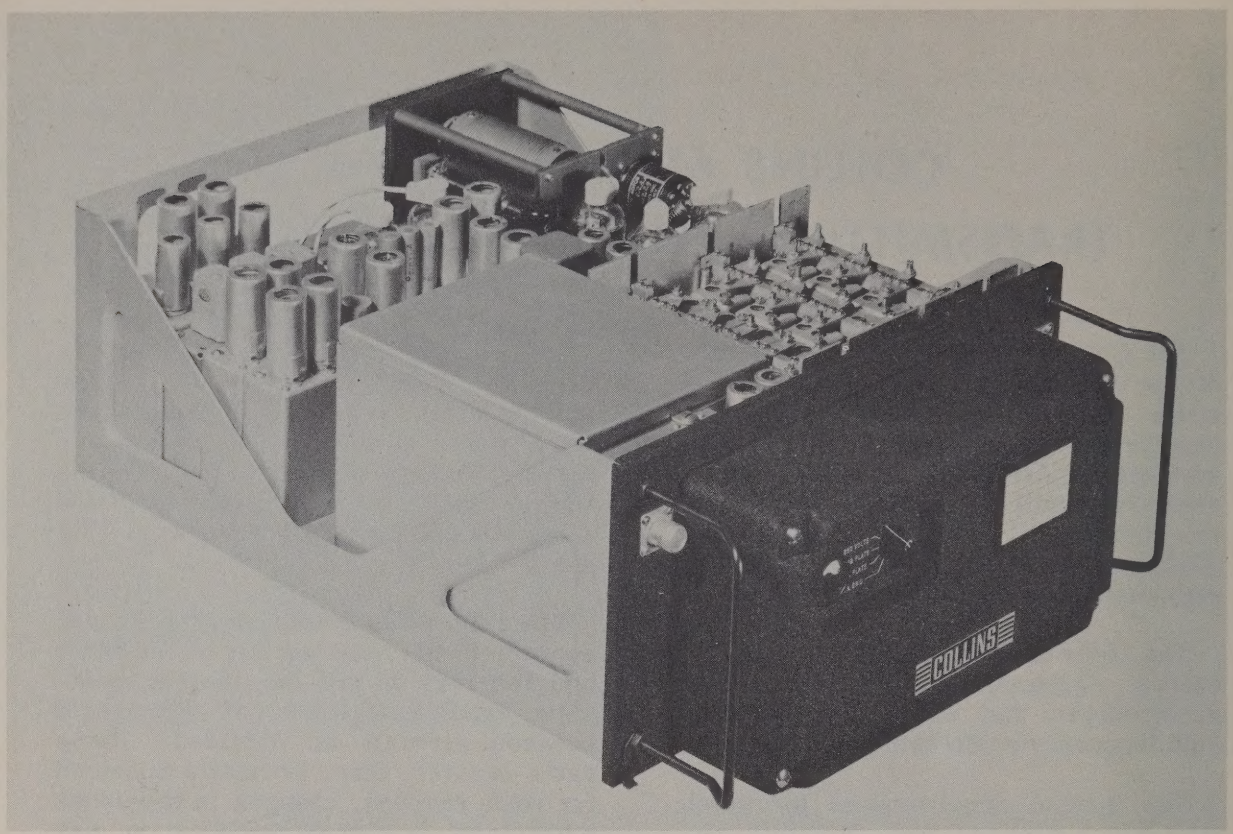
The 618S Equipment provides both transmitting and receiving facilities for up to 144 crystal controlled frequencies assigned in the frequency range of 2.0 to 25.0 mc. The frequency control system was chosen to provide common usage of crystals for both transmitting and receiving. The full power transmitter output of 100 watts is available throughout the frequency range.

System flexibility is provided by the use of automatic tuning. The set-up of a new frequency channel merely requires that the channel selection control be turned to the new channel designation. All circuits within the main case are tuned automatically and the Collins 180L-2 antenna matching network will automatically make all antenna adjustments.

Since the 180L-2 antenna network will operate with a wide variety of antennas, and requires no pre-information, complete interchangeability of equipments between aircraft is provided. Ramp radio service time, normally required for route changes, changes in frequency assignment or antenna modification, has been virtually eliminated.

The intial set-up of a new frequency consists merely of plugging in the proper crystal. All circuits, including antenna, are tuned automatically and no installation adjustments are normally necessary.

A unique feature of the 618S is the "Modular" construction employed. A standard unit of volume or "Module" into which all standard aircraft case sizes can be subdivided, has been determined. All subassemblies have dimensions which are multiples of those of the basic "Module". This type of construction not only offers the advantages of standardized plug-in subassemblies from a maintenance and repair viewpoint, but also allows possible interchangeable use of a subassembly in several types of equipment. For example, a servo amplifier or audio amplifier might well be used in both H-F and VHF equipments. Possibly an even more important advantage of this construction



Type 618S-1 Transmitter-Receiver, Top Inside View

is the ease with which future modifications can be incorporated into the equipment.

The design of the 618S also considers provision for future needs of the air transport industry. A Collins Stabilized Master Oscillator (S. M. O.) is being designed to replace the 144-crystal oscillator unit when complete channelization is required. This facility completely eliminates the requirement of individual crystals for each frequency, yet provides crystal controlled stability on any frequency within the tuning range of the equipment. Provisions have been made in the design of the 618S to accommodate the Stabilized Master Oscillator in the space now occupied by the crystal oscillator and adjacent module space left for this purpose. Through use of "Modular" construction and careful selection of the basic frequency scheme, a high degree of flexibility for future modifications has been provided. For example, a low frequency (250 KC) source of injection has been used in the transmitter. This source can be replaced by one which is modulated for FSK teletype or single sideband transmission. Modification or replacement of some of the existing "Modules" would, of course, be necessary for single sideband operation, but every step has been taken to make this a truly practical consideration for the future.

Detailed Description

The 618S-1 consists of a main chassis and panel which forms the mounting base for a number of plug-in units. These units are all removable from the top of the chassis by means of captive hold-

down screws. The front panel is constructed to make good electrical contact with a dust cover which is removable from the rear of the unit. This type of construction along with the line filters which are located in the shockmount, allows good radiation shielding of harmonics and spurious signals from the high level r-f stages of the transmitter.

All electrical connections to these plug-in units are made through plugs and coaxial connectors located on the bottom of the chassis. The connections to the external power supply and control boxes are made through two connectors mounted in the rear of the main chassis and making connection with mating plugs mounted on the shockmount.

An easily removable cover located on the front panel houses the blower motor and the positioning and tuning mechanism needed for remote channel selection of the transmitter and receiver.

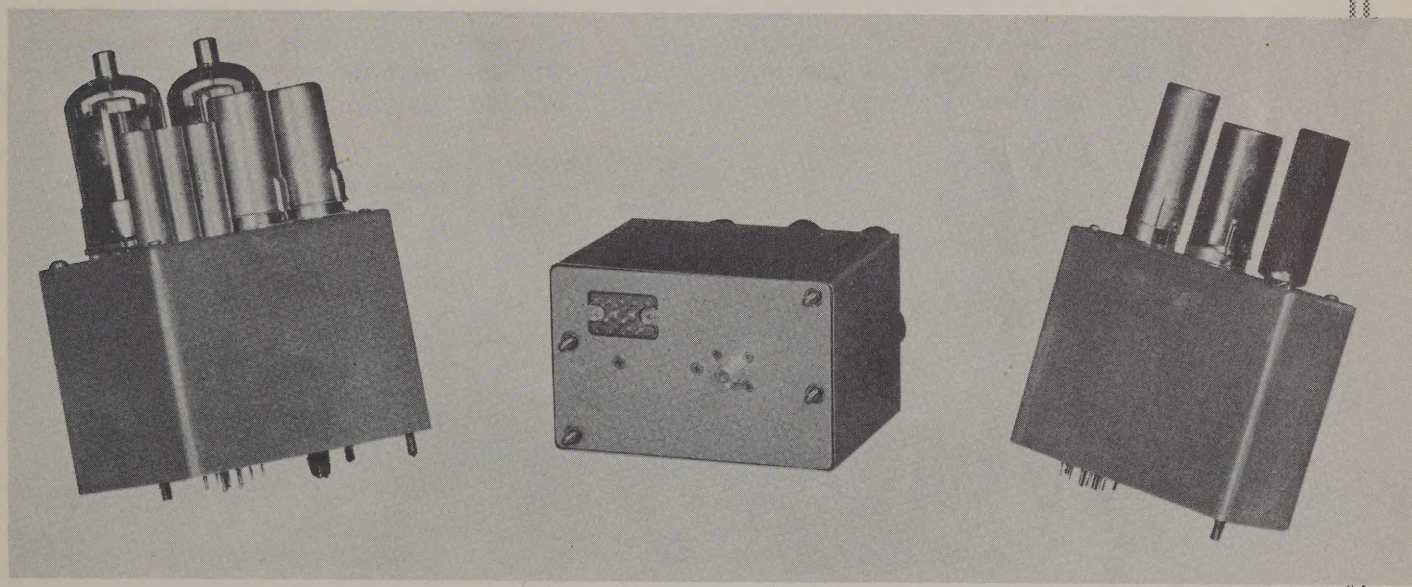
Individual plug-in units which require mechanical linkage to each other or to the front panel, are built with quick disconnect, flexible couplers to allow quick and easy removal from the main chassis. Once these mechanical linkages are synchronized, it is possible to remove and replace units without additional alignment.

A blower motor and blower mounted on the front panel draws air in through an air filter, and distributes this air to any portion of the set that requires forced air cooling. This is done by locating holes in the bottom chassis at appropriate places to direct a stream of air on the components to be cooled.

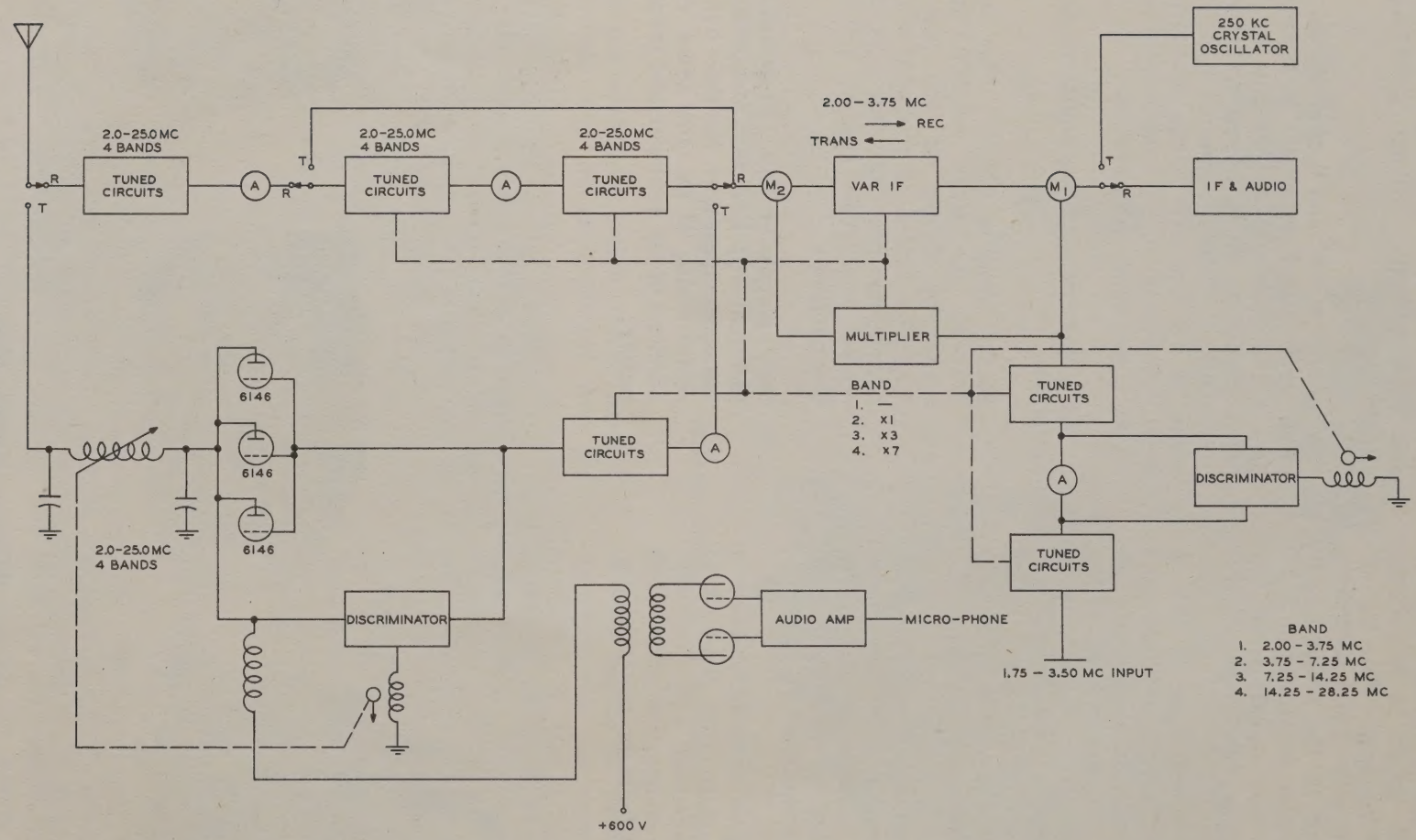
The plug-in units of this equipment are as follows:

1. Servo Amplifier Unit. This unit contains the servo amplifier for automatic tuning of the power amplifier under control of a phase sensitivity discriminator. It includes two tubes and an a-c to d-c chopper.

2. Servo Amplifier Unit. This unit is identical with Unit #1. It contains the servo amplifier for the automatic tuning of the low level r-f portions of the receiver and transmitter.



Typical "Module" Outside View



Type 618S-1 Transmitter-Receiver, Block Diagram

3. Audio Amplifier Unit. This "Module" consists of the receiver audio amplifier. It includes all audio components from the output of the 2nd detector to the audio output transformer, two tubes and one transformer.

4. Relay "Module". This assembly contains all necessary relays and similar components that cannot be logically assigned to any one given unit.

5. Fixed I-F Unit. The fixed i-f unit includes the mechanical filter, i-f amplifiers, 2nd detector, AVC and limiter circuits. Five tubes plus the mechanical filter are used in this circuit.

6. 250 KC Crystal Oscillator Unit. The 250 KC crystal oscillator for the transmitter, and the remotely controlled beat frequency oscillator are included in this two-tube unit.

7. 144 Crystal, Remote Selected Crystal Oscillator. This includes the 144 crystal socket and selector assembly and the crystal oscillator. This unit contains one tube.

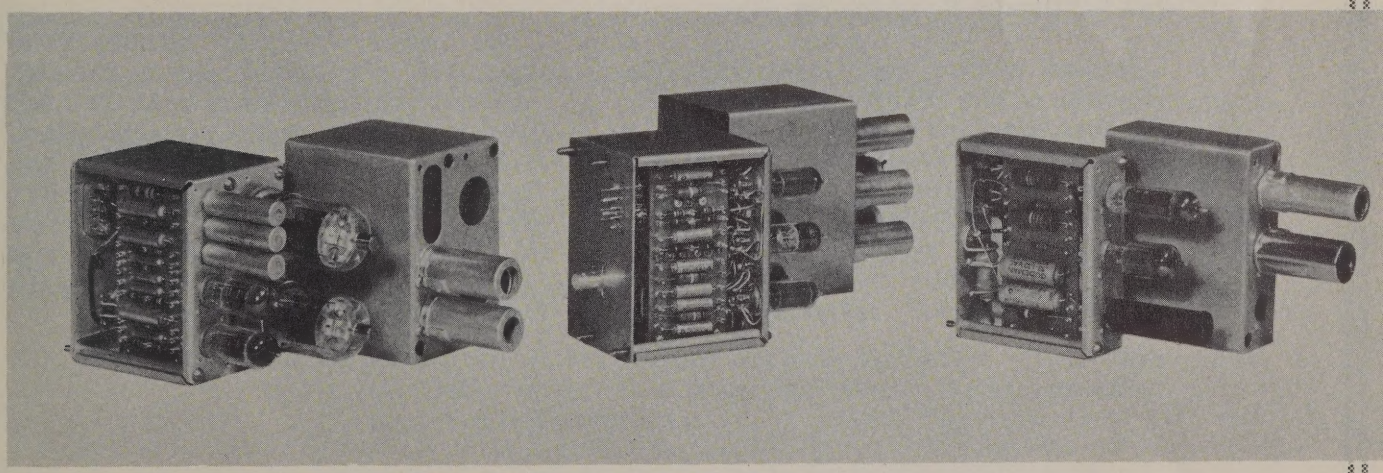
8. Modulator. Three miniature tubes plus the two modulator tubes are included in this "Module" for the speech amplifier, clipper, phase inverter and modulator tubes for class AB2 modulation of the final amplifier.

9. Power Amplifier. This unit includes the p-a tubes, the motor driven screw coil, band switch, discriminator, and other components necessary for the automatic tuning of the final amplifier. Three Power Amplifier tubes are used in a parallel connection.

10. Tuner Assembly. This unit includes all tuned circuits for the receiver front end, the variable I. F., multiplier coils, discriminator coils for automatic tuning and the transmitter exciter coils. Also included are band switches and necessary relays. This unit contains 11 tubes.

618S-1 Operation

The circuit functions of the 618S can best be described by referring to the block diagram. Output from the frequency generator (144 channel crystal selector or S. M. O.) in the frequency range 1.75 to 3.5 mc is applied across a tuned circuit at the grid of the tuning discriminator. The plate of this discriminator has a similar tuned circuit mechanically ganged with the first



Typical "Module" Inside View

circuit and with all other low level tuned circuits of the equipment. The output of the discriminator in conjunction with a servo-amplifier controls a 400-cps servo motor which drives the tuning shafts of these circuits. The discriminator is satisfied only when the grid and plate voltages of the discriminator tube are 180 degrees out of phase, thus indicating resonance of the plate coil. In this manner the low-level circuits of the transmitter-receiver are automatically resonated when excitation is applied.

When transmitting, the oscillator output is mixed with a 250-KC injection frequency to provide a variable intermediate frequency of 2.0 to 3.75 mc on all bands. The variable i-f output is then added in the second mixer to various multiplies of the oscillator frequency depending upon the frequency band selected. The resultant frequency is the required output frequency which is filtered, amplified and used to drive the power amplifier. The following chart shows the frequencies involved on the various frequency bands.

Band	Oscillator	Fixed Injection or Receiver I. F.	Variable I. F.	Multiplier	Output or Input
1	1.75 - 3.5	.250	2.0 - 3.75	Not Used	2.0 - 3.75
2	1.75 - 3.5	.250	2.0 - 3.75	1.75 - 3.5	3.75 - 7.25
3	1.75 - 3.5	.250	2.0 - 3.75	5.25 - 10.5	7.25 - 14.25
4	1.75 - 3.5	.250	2.0 - 3.75	12.25 - 24.5	14.25 - 28.25

The process is reversed when receiving. The signal from the antenna is amplified and applied to the mixer previously referred as the second mixer. A multiple of the oscillator frequency is injected to produce the 2.0 to 3.75 mc variable i-f frequency. Output from the variable i-f channel is combined with the oscillator frequency to produce the 250-KC fixed I. F. of the receiver.

Several factors were involved in the selection of this basic frequency scheme. A transmitter and receiver operating in this frequency range with a common source of injection using conventional side-stepping techniques would have relatively poor rejection of spurious responses in either the transmitter or receiver. Careful analysis of this scheme shows both mixers to be completely free of low-order spurious outputs. In order to accommodate future incorporation of single-sideband transmission using filter separation techniques, it was necessary to develop a system having a relatively low frequency injection source. This feature will be equally applicable to FSK transmission.

The power amplifier utilizes three type 6146 tubes connected in parallel. Its tank circuit consists of band switched fixed condensers and a variable inductance which is operated by a servo motor. This motor is supplied information by a phase discriminator operating around the power amplifier stage. The tank circuit is a pi network and automatically tunes and loads into a 52-ohm load.

Specifications For 618S-1 Transmitter-Receiver

Frequency Range: 2.0 to 25.0 mc inclusive.

Number of Frequency Channels: Up to 144.

Type of Frequency Control: Quartz Crystal CR-18/U.

Frequency Change Method: Autopositioner type remotely controlled switching mechanisms. Automatic resonating of exciter, power amplifier and antenna matching circuits. Frequency selector system in accordance with ARINC characteristic No. 524.

Size: C1-D case size per RTCA paper. 46-57/EC-14 "Radio Equipment Form Factors: dated April 17, 1947, as amended by Paper 44-47/EC-28, dated September 5, 1947.

Weight: 60 lbs including shockmount.

Number of Tubes: 32

Characteristics of Transmitter Section

R-F Power Output: 100 watts minimum from transmitter.

R-F Output Impedance: 52 ohms (RG-8/U).

Types of Emission: A-3 (AM Radiotelephony).
A-1 (CW Telegraphy).

Modulation Capacity: 95%

Altitude Ranges: Full power operation up to 35,000 ft.

Audio Characteristics:

Input: 100 ohm input from standard aircraft carbon microphone.

Speech Clipping: Up to 15 db.

Frequency Response: ±2 db from 300 to 3500 cps with rapid attenuation above and below these frequencies.

Distortion: Less than 5% at 90% modulation.

Frequency Stability: Less than ±0.007% under service conditions. Less than ±0.0005% variation in frequency when a given crystal is operated in any socket.

Channeling Time: 8 seconds maximum.

Spurious Radiation: At least 40 db below carrier level. (Additional attenuation provided by associated antenna coupler).

Sidetone: Developed by rectification of carrier for voice operation. 400 cps audio keyed by carrier for cw operation. Sidetone output from receiver audio circuits.

Keying: Break-in operation up to 30 words per minute using a common antenna for transmitting and receiving.

Characteristics of Receiver Section

Sensitivity: 3 uv maximum for 6 db signal plus noise to noise ratio with standard test signal modulated 30% at 1000 cps, or for 10 db signal plus noise to noise ratio on cw reception.

Sensitivity Control: 60 db range of control with a 5000 ohm external control.

AVC: Maximum output variation of 3 db for signal from 5 to 100,000 microvolts. No overload below 1-volt signal input.

Selectivity:

Selectivity	Bandwidth
6 db	6 kc
60 db	15 kc

I. F. & Image Rejection: 60 db minimum.

Audio Output: Power - 500 mw into 300 ohm load

Distortion - 10% maximum

Response - ±3 db 300 to 3500 cycles per second.

Noise Limiting: Series type carrier biased peak noise limiter.

CW Reception: Remote BFO control with ±3000 cps control range.

416W-1 Power Supply

1. Mechanical Description - The 416W-1 power supply conforms to the case size MT-A1-B as outlined in RTCA Paper 46/57/EC-14. The weight of this unit complete with mounting does not exceed 20 lbs.

The power plug for this equipment is mounted in the rear and engages a mating plug on the mounting.

Fuse holders and spare fuses are mounted on the front panel of the equipment. These fuses are for overload protection of the high voltage circuits in the 618S-1 trans-receiver.

2. Electrical Description - A dynamotor mounted on the 416W-1 provides the high voltage for the modulator and power amplifier and also provides the screen voltage for these stages. This dynamotor operates only on key-down phone position and on cw position of the transmitter.

In addition to the dynamotor, the 416W-1 utilizes two selenium rectifiers, one to furnish high voltage for the receiver and the other to furnish bias for the modulator tubes.

The power input requirements for the 416W-1 are as follows:

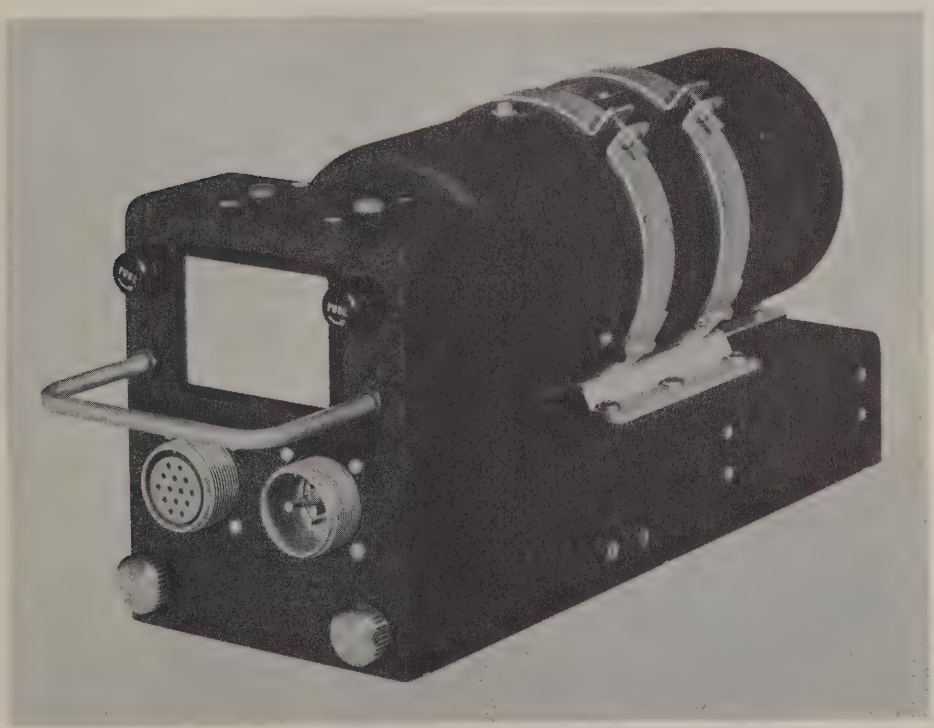
27.5 vdc - 28 amps

115 v - 380-420 cps -
single-phase - 15 watts

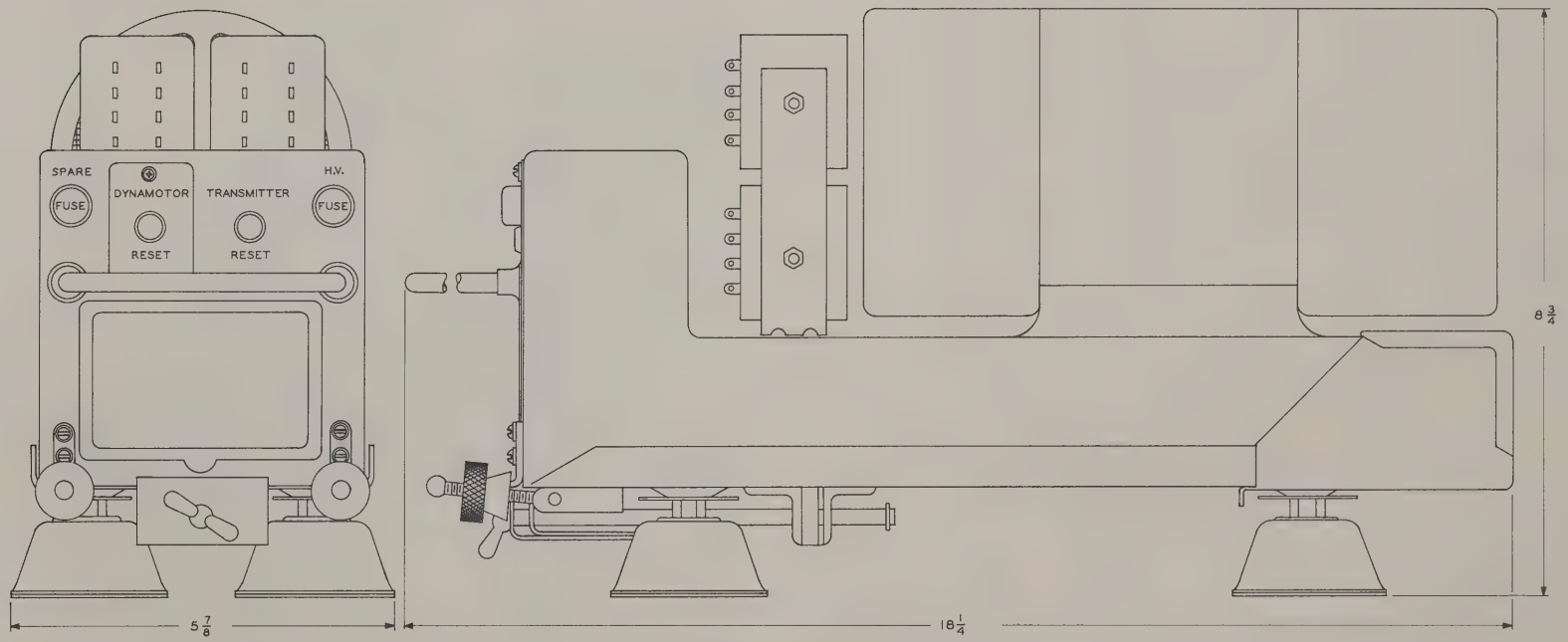
115 v - 320-1000 cps -
single-phase - 100 watts

The output of the 416W-1 in as follows:

(600 v - 550 ma)
(250 v - 150 ma) Dynamotor



Type 416W-1 Power Supply, Front View



Type 416W-1 Power Supply, Outline Dimensional Drawing

(250 v - 180 ma) Selenium Rectifier
(-50 v - 10 ma) Selenium Rectifier

If the market demands, a dynamotor power supply will be designed to eliminate the 320-1000 cps requirement.

180L-2 Automatic Tuning Unit

The 618S-1 output network is designed to be used with the 180L-2 automatic antenna tuning network. This network matches a 50-to-100 foot aircraft antenna or any similar specified antenna to the 52-ohm output of the transmitter

Specifications for the 180L-2 are as follows:

Power Requirements:

115 v, 380-420 cycles - single-phase - 15 watts

27.5 vdc - 2.0 amps

250 vdc - .025 amps

Size: Width, 10-3/16

Height, 8-15/16

Depth, 13-1/16

These dimensions include shockmount and are over-all dimensions.

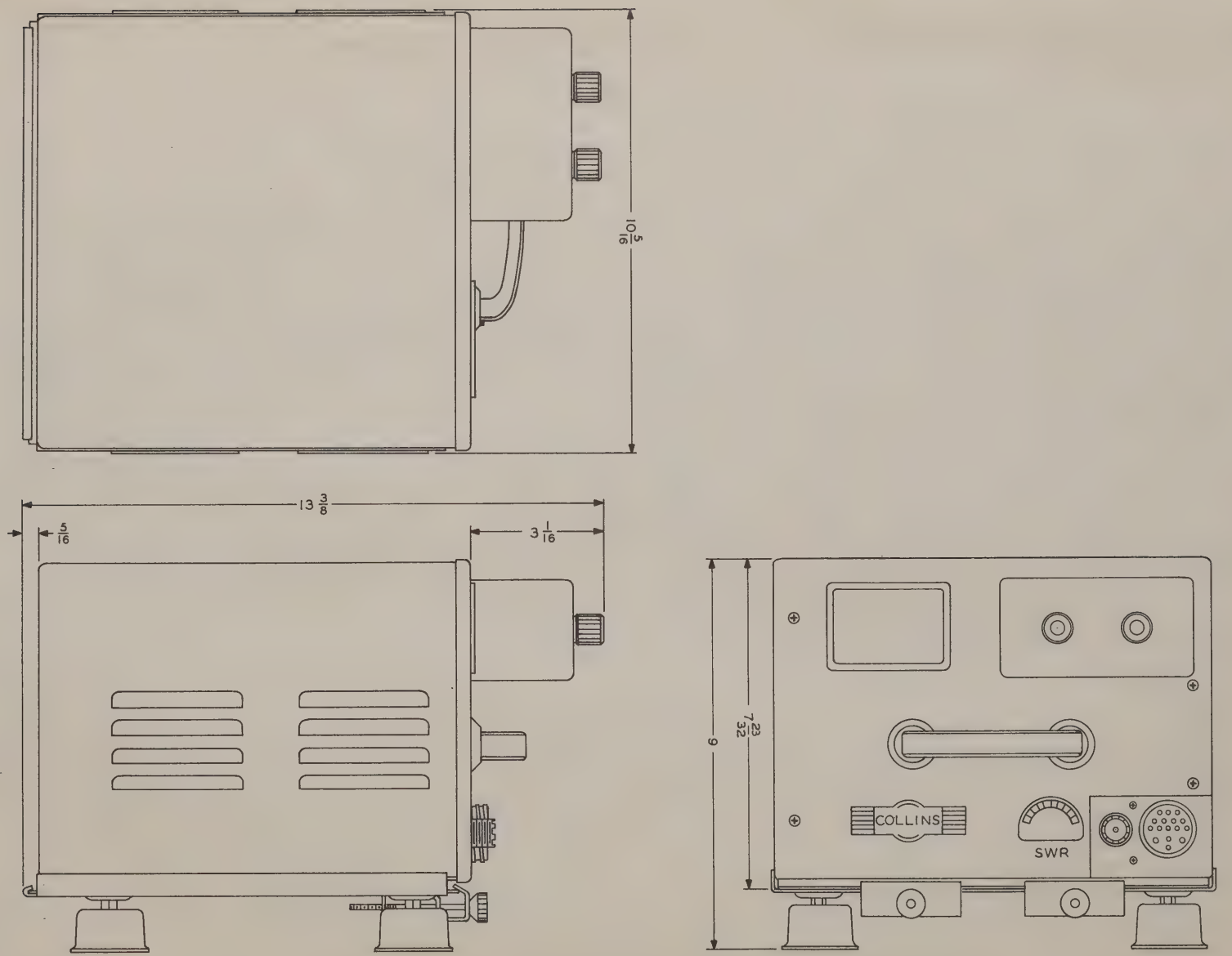
Weight - 20 lbs including shockmount.

Channel Change Time:
Maximum, 15 seconds.

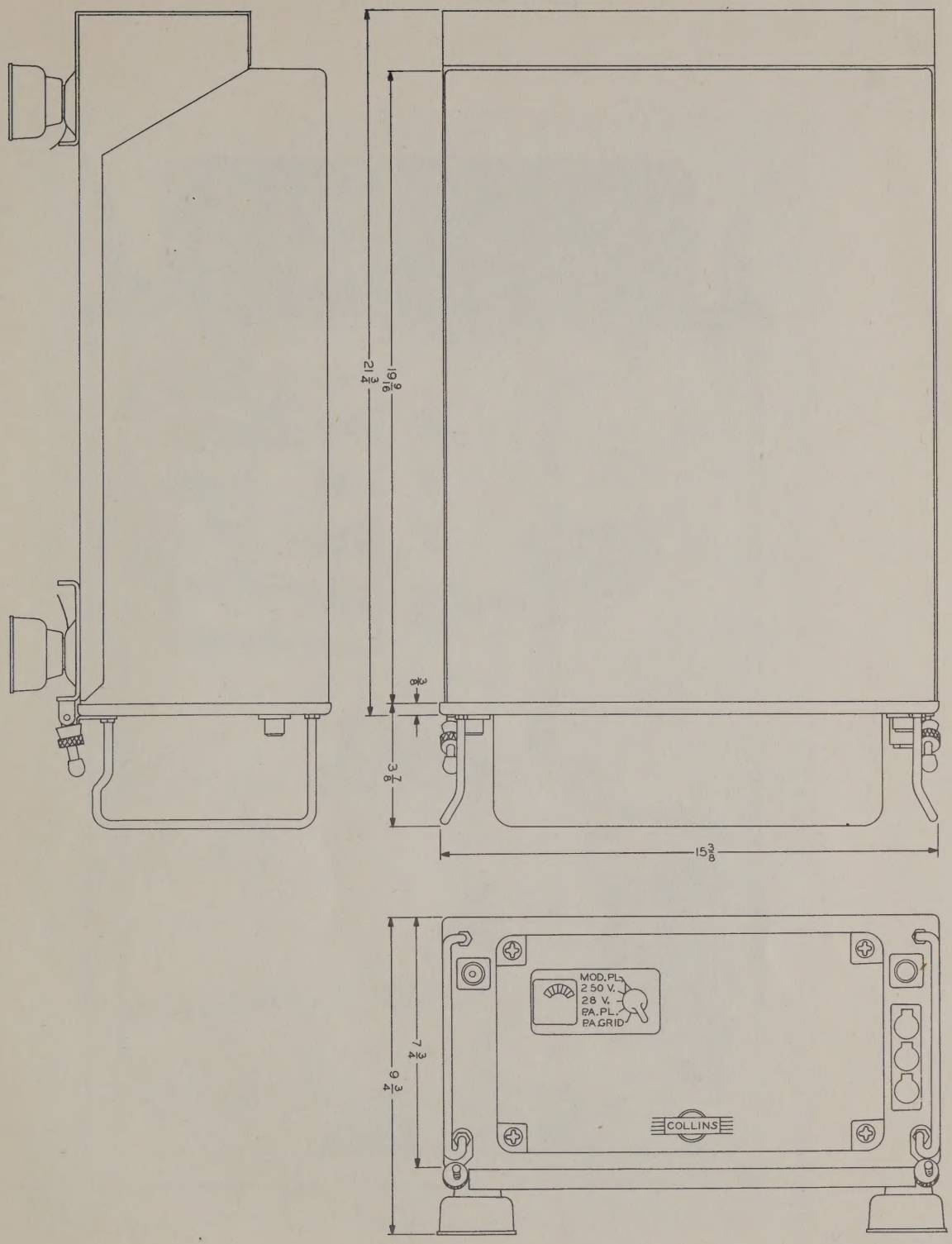
Average, 5 seconds.

Condensed Specification For 618S-1

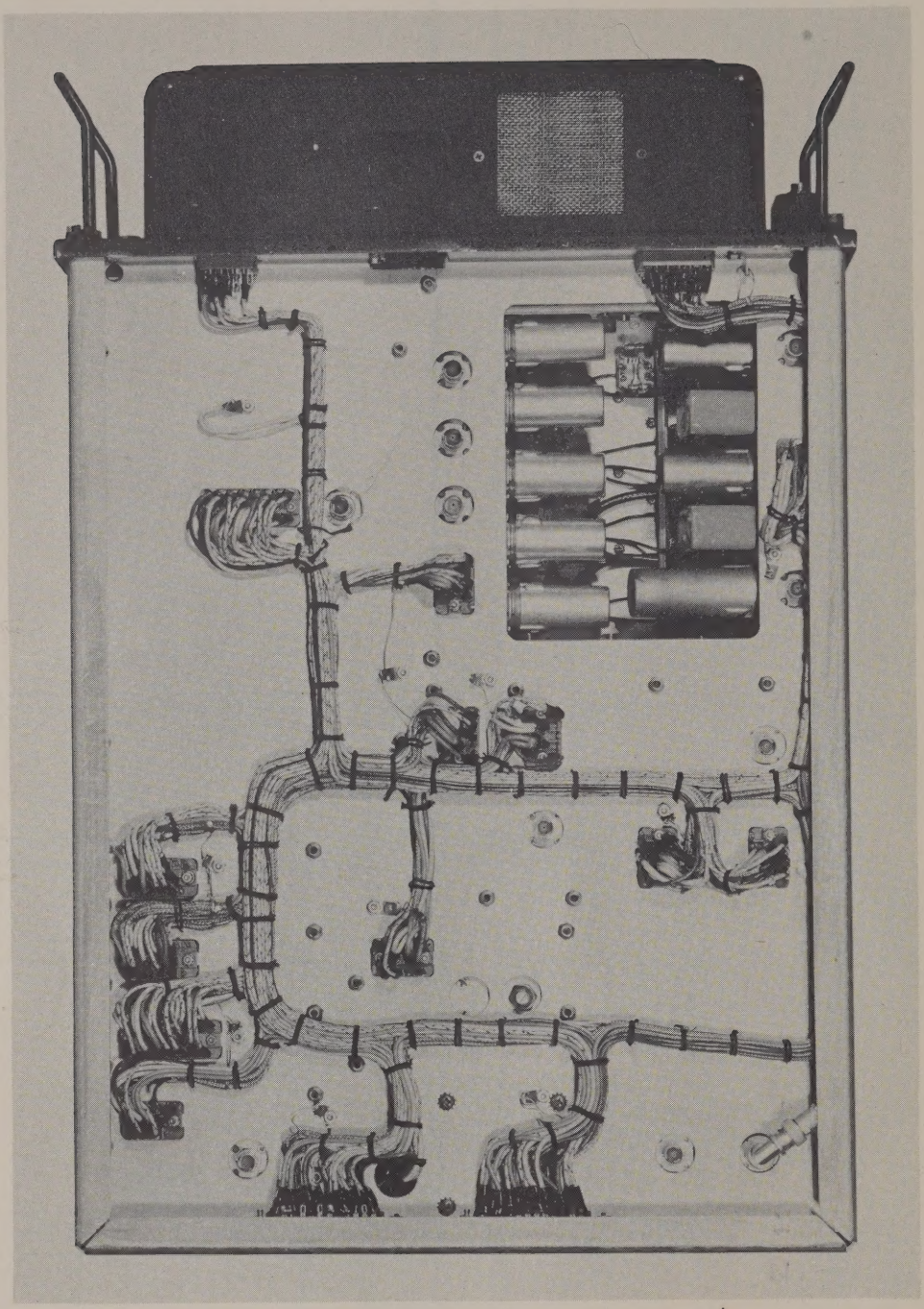
Weight - with shockmount	60
Power Supply - with shockmount	20
Channels	144
Power Output	100 watts
Type of Emission	A1-A3
Frequency Range	2-25 mc
Modulator Capability	95%
Frequency Response	2 db 300-3500 cycles
AVC Characteristics	3 db 5-100,000 uv
Power Source	27.5 vdc 115 v--380-420 cycles - single-phase
Speech Clipping	15 db



Type 180L-2 Automatic Tuning Unit, Outline Dimensional Drawing



Type 618S-1, Outline Dimensional Drawing



Type 618S-1 Transmitter-Receiver Inside Bottom View

COLLINS RADIO COMPANY

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